

Cell Division

Teacher Directions

This activity is suitable for an independent assignment, Think-Pair-Share, or group task. Student will get practice in analyzing data and presenting this analysis. They will get an opportunity for guided practice in data interpretation, and drawing supported conclusions.

Student directions

Students in a Grade 10 class observed cells from *Allium* (onion) root tips and stems to determine which area had the greatest number of cells in cell division (mitosis) or in interphase (non-dividing). Each student in the class observed five samples of each area, root tip and stem tip. In each slide 50 cells were randomly selected, identified and tallied. Cells were categorized as dividing (mitosis) or non-dividing (interphase). In the table below one student's raw cell count has been provided.

Table 1: Counts of cells in Interphase and Mitosis in *Allium* (Onion) root tips and stem tips in five samples from five prepared slides viewed under light microscopy at 400X magnification

Cell Type	<i>Allium</i> Root tip		<i>Allium</i> Stem Tip	
Sample	Interphase	Mitosis	Interphase	Mitosis
1	35	15	42	8
2	28	22	39	11
3	37	13	29	21
4	29	21	40	10
5	33	17	44	6

1. Determine the average number of mitotic and interphase cells for both *Allium* root and stem tips.
2. Construct a pie graph for each cell type (root tip and stem tip) to show the proportion of cells in mitosis and interphase.
3. Construct a graph to compare the average number of cells in interphase or mitosis for each of the two cell types.
4. State which of these areas of growth in the *Allium* has the greatest average number of dividing cells.
5. If the proportion of dividing cells can represent the rate of cell division and therefore growth, deduce which of the tissue areas is growing fastest.
6. Describe three limitations to these data that might be sources of error in your conclusion. Be sure to include why these situations are limiters. Explain how they might be corrected if this laboratory was going to be repeated.

Support material

Markschemes/markings notes:

1. **Determine** the average number of mitotic and interphase cells for both Allium root and stem tips.

Cell Type	Life Cycle Phase	Average
Allium Root Tip	Interphase	32.4 = 32
	Mitosis	17.6 = 18
Allium Stem Tip	Interphase	38.8 = 39
	Mitosis	11.2 = 11

2. **Construct** a pie graph for each cell type (root tip and stem tip) to show the proportion of cells in mitosis and interphase.

Circle should reflect:

Allium Root tip - Interphase = 230°

Mitosis = 130°

Allium Stem tip - Interphase = 281°

Mitosis = 79°

3. **Construct** a graph to compare the average number of cells in interphase or mitosis for each of the two cell types.

Graph should be a bar graph as the X variable is discrete. Ideally students should use one colour for Root tip and one for Stem tip and should be organized to clearly compare. Axes must be labeled and graph should be titled to mention both variables and the fact the count was of 50 cells.

4. **State** which of these areas of growth in the Allium has the greatest average number of dividing cells.

Allium root tip has highest mean number of dividing cells (mitosis)

5. If the proportion of dividing cells can represent the rate of cell division and therefore growth, **deduce** which of the tissue areas is growing fastest.

The Allium root tip is growing the faster as the proportion of the pie graph representing mitosis is larger than the stem tip

6. **State** three limitations to these data that might be sources of error in your conclusion. **Describe** how they might be corrected if this laboratory was going to be repeated.

Limitation #1: Only 50 cells were counted in each tip so the size of the sample is small

Explanation #1: More cells in a tip could be counted; data could be pooled across many students to get a larger number of counts; all students could count one tip but count all cells in the growth region and then pool data across class

Limitation #2: Only 5 tips were counted for each cell type this is a very small sample to represent an entire population of organisms

Explanation #2: Data could be pooled across many students to get a larger number of counts; all

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students could count more tips than pool data across class;

Limitation #3: Random sampling is not described but may be biased by selection of area

Explanation #3: all students could count one tip but count all cells in the growth region and then pool data across class; a system for randomizing sample selection could be established

Any other reasonable answer

Examiner notes:

Command Terms Guidesheet

Objective 1

Define - Give the precise meaning of a word, phrase or physical quantity.

Draw - Represent by means of pencil lines.

Label - Add labels to a diagram.

List - Give a sequence of names or other brief answers with no explanation.

Measure - Find a value for a quantity.

State - Give a specific name, value or other brief answer without explanation or calculation.

Objective 2

Annotate - Add brief notes to a diagram or graph.

Apply - Use an idea, equation, principle, theory or law in a new situation.

Calculate - Find a numerical answer showing the relevant stages in the working (unless instructed not to do so).

Describe - Give a detailed account.

Distinguish - Give the differences between two or more different items.

Estimate - Find an approximate value for an unknown quantity.

Identify - Find an answer from a given number of possibilities.

Outline - Give a brief account or summary.

Objective 3

Analyse - Interpret data to reach conclusions.

Comment - Give a judgment based on a given statement or result of a calculation.

Compare - Give an account of similarities and differences between two (or more) items, referring to both (all) of them throughout.

Construct - Represent or develop in graphical form.

Deduce - Reach a conclusion from the information given.

Derive - Manipulate a mathematical relationship(s) to give a new equation or relationship.

Design - Produce a plan, simulation or model.

Determine - Find the only possible answer.

Discuss - Give an account including, where possible, a range of arguments for and against the relative importance of various factors, or comparisons of alternative hypotheses.

Evaluate - Assess the implications and limitations.

Explain - Give a detailed account of causes, reasons or mechanisms.

Predict - Give an expected result.

Show - Give the steps in a calculation or derivation.

Sketch - Represent by means of a graph showing a line and labelled but unscaled axes but with important features (for example, intercept) clearly indicated.

Solve - Obtain an answer using algebraic and/or numerical methods.

Suggest - Propose a hypothesis or other possible answer.

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Subject:

Biology

DP Component & Criteria:

Group 4 / Sciences

Component type:

Internal

MYP Criteria:

Group 4 / Sciences